THE ROLE OF MODELS IN RELATING THEORY AND EXPERIMENT

In order to test a theory by experiment it is first of all necessary to know what the theory predicts when applied to a particular physical system under specified initial and/or boundary conditions. In many cases the theories of modern physics are too complicated mathematically for such predictions to be calculated directly. There exists what may be termed the computation gap between what we would like to predict, and what can, in practical terms, be attempted.
In such a situation physicists often have recourse to so-called theoretical models. in which some of the complicating assumptions of the exact theory are replaced by simplified approximations. The purpose of the present paper is to characterize this idea of a theoretical model with greater precision and to discuss the question of whether the refutation of a prediction made by a model, in the light of experiment, should be regarded as bearing on the original theory or on the approximations used in deriving the model. A number of specific examples are given which illustrate the pitfalls which can arise from an uncritical use of models in relating theory and experiment.

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